

# ***Problem Area Linkages***

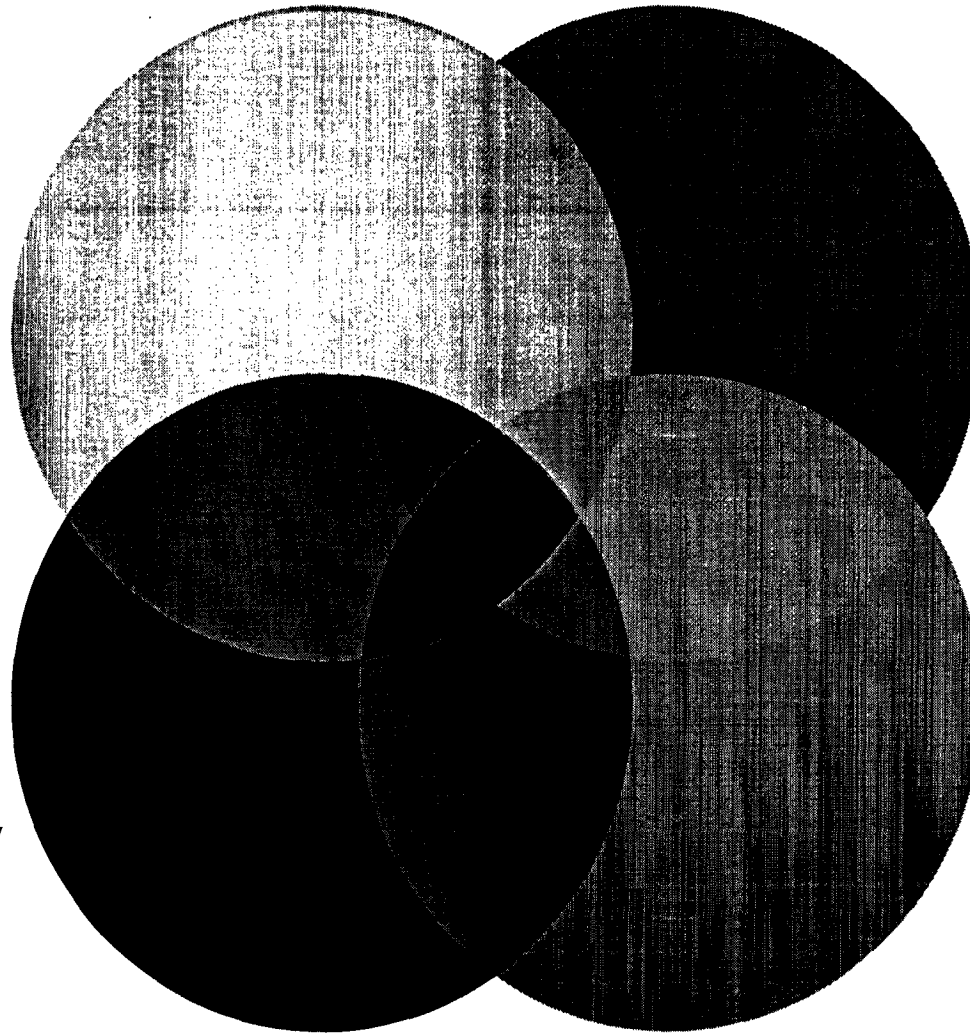
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**Ecosystem  
Restoration**

**Water  
Supply  
Reliability**

**Water  
Quality**

**Levee  
System  
Integrity**

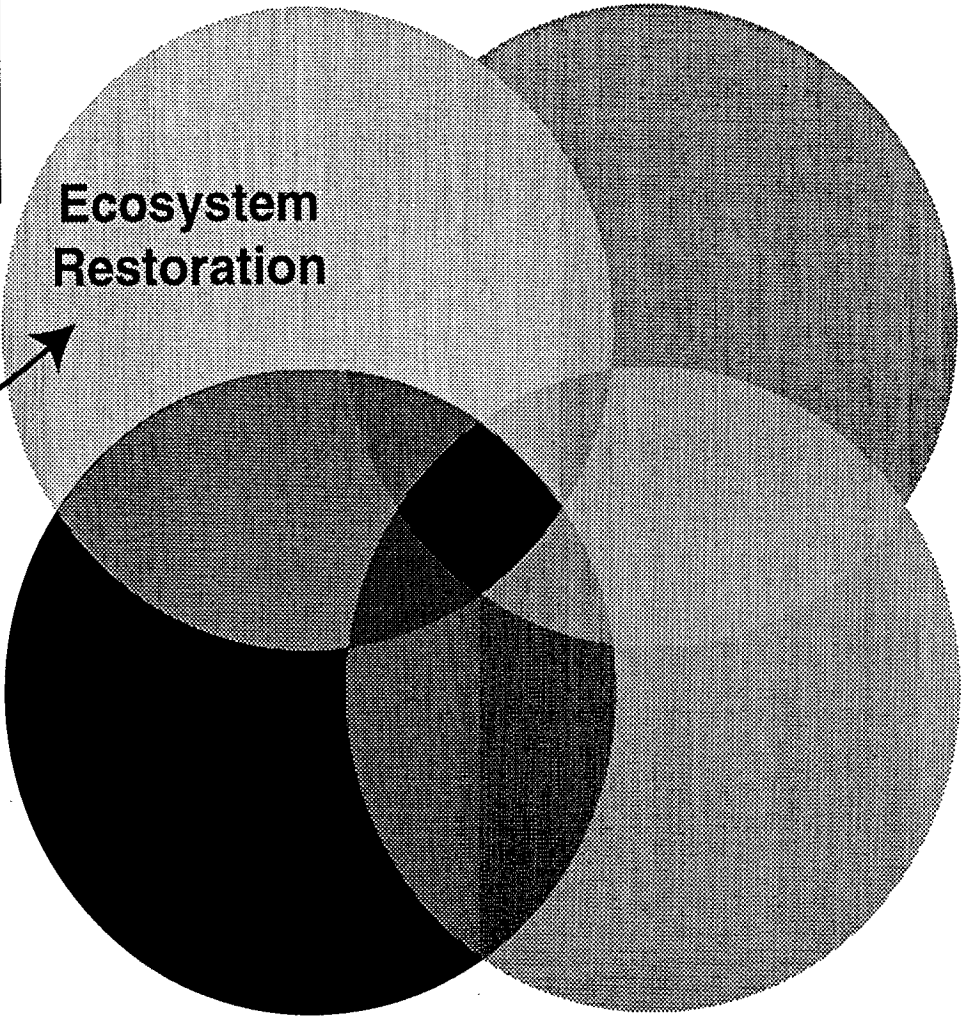


# ***Single Purpose Model***

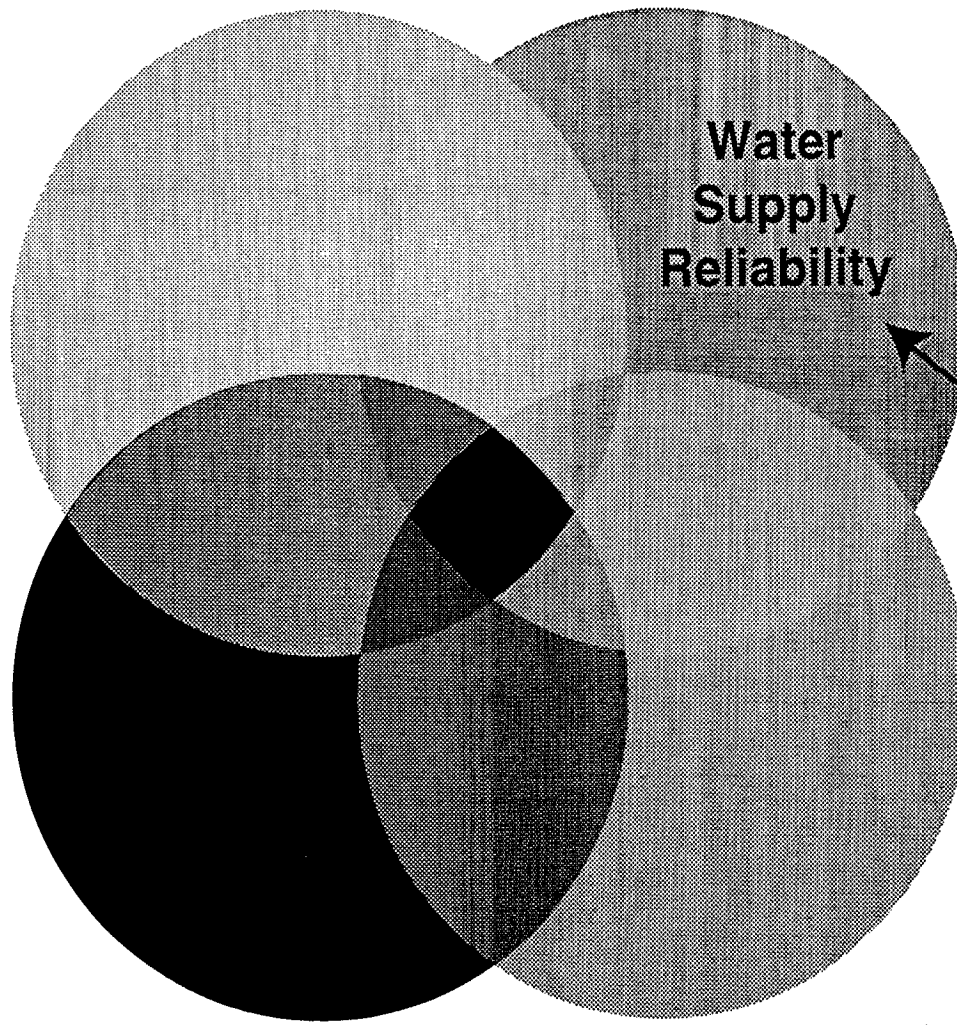
**Examples:**

- List Species
- Shut down Pumps

**Ecosystem  
Restoration**



# ***Single Purpose Model***

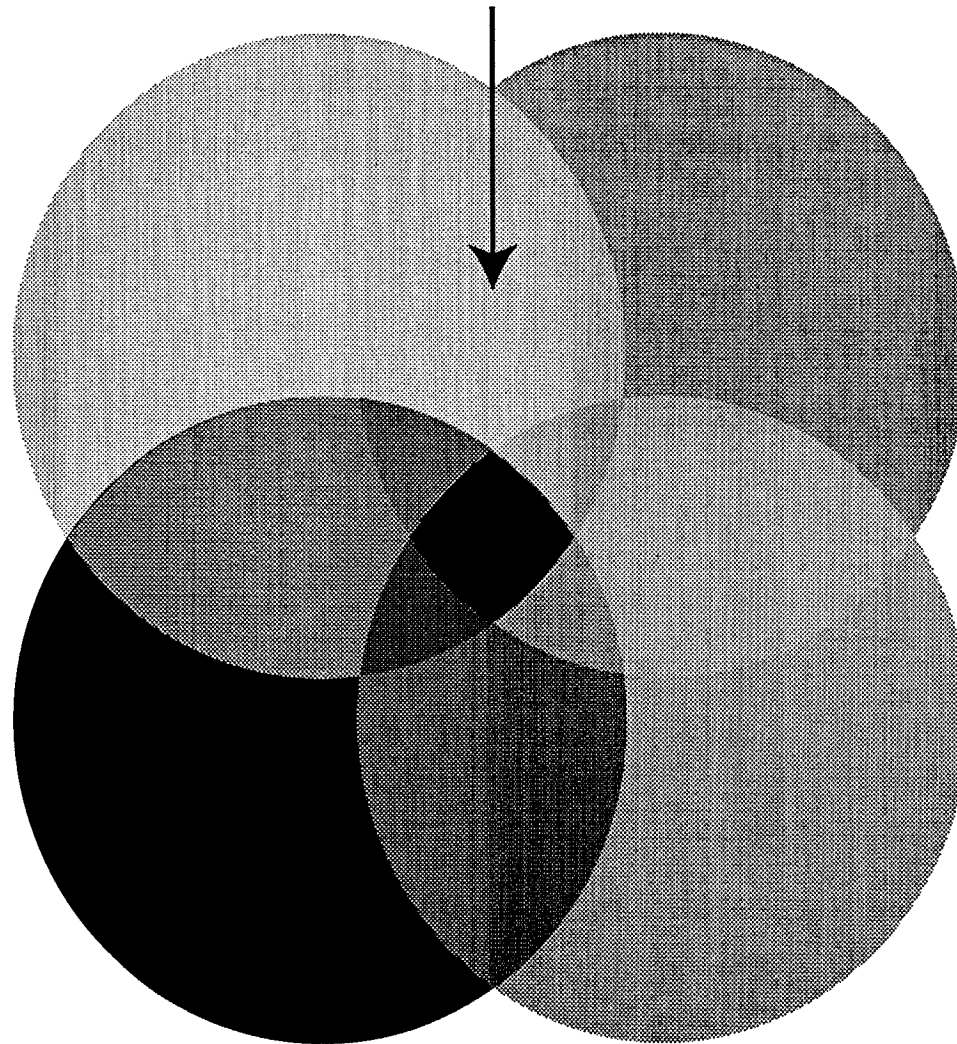


## **Examples:**

- **Build Reservoir**
- **Increase Reservoir**

# ***Multi-Purpose Model***

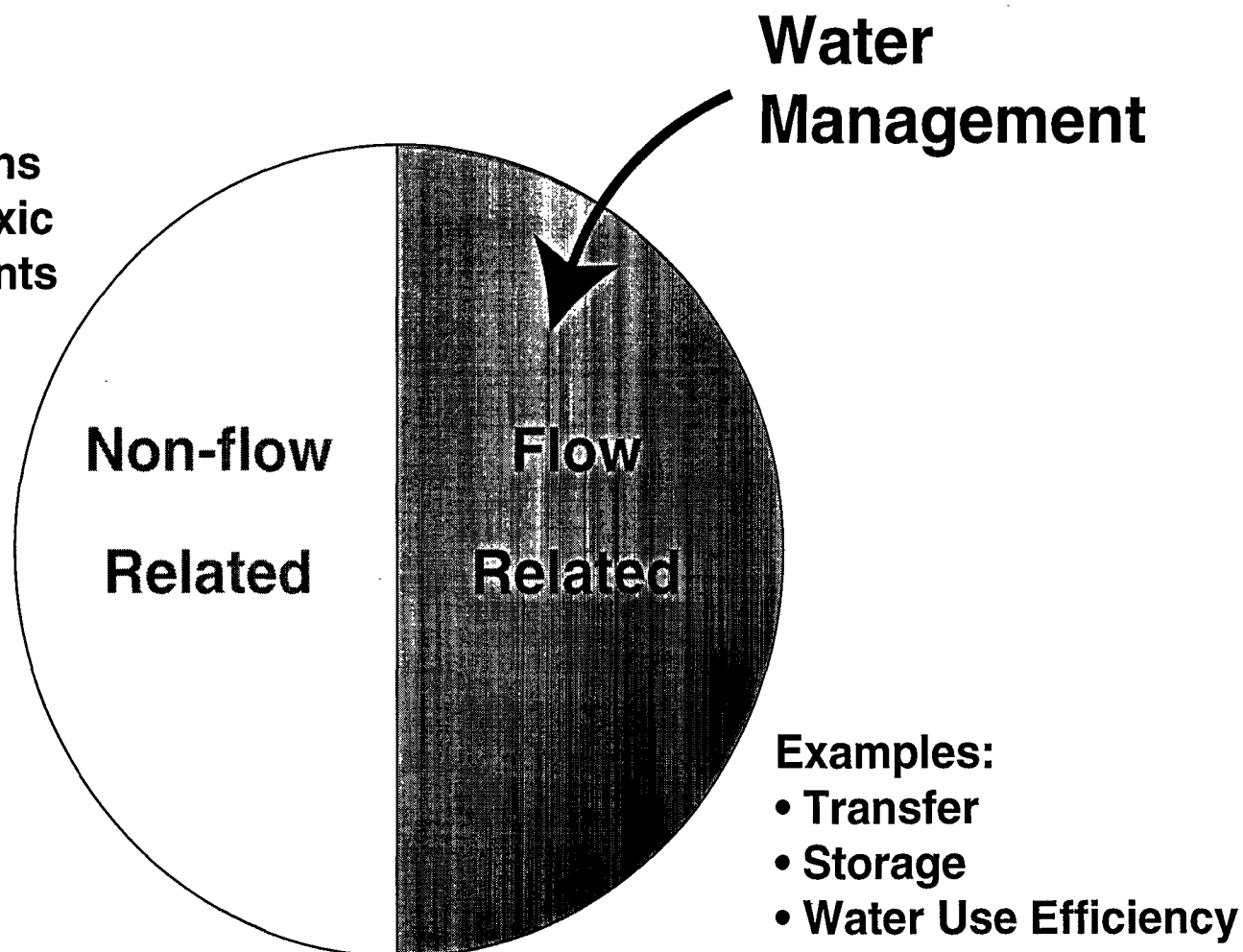
**Resource  
Management**



# ***Resource Management Model***

**Examples:**

- Habitat
- Fish Screens
- Reduce Toxic Contaminants



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# Yearly Total Delta Outflow



CALFED  
BAY-DELTA  
PROGRAM

# ***Historical Monthly Outflow Range***

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- High                      15,670,000 acre feet  
                                 March 1983
- Low                        179,000 acre feet  
                                 September
- Average                1,197,000 acre feet

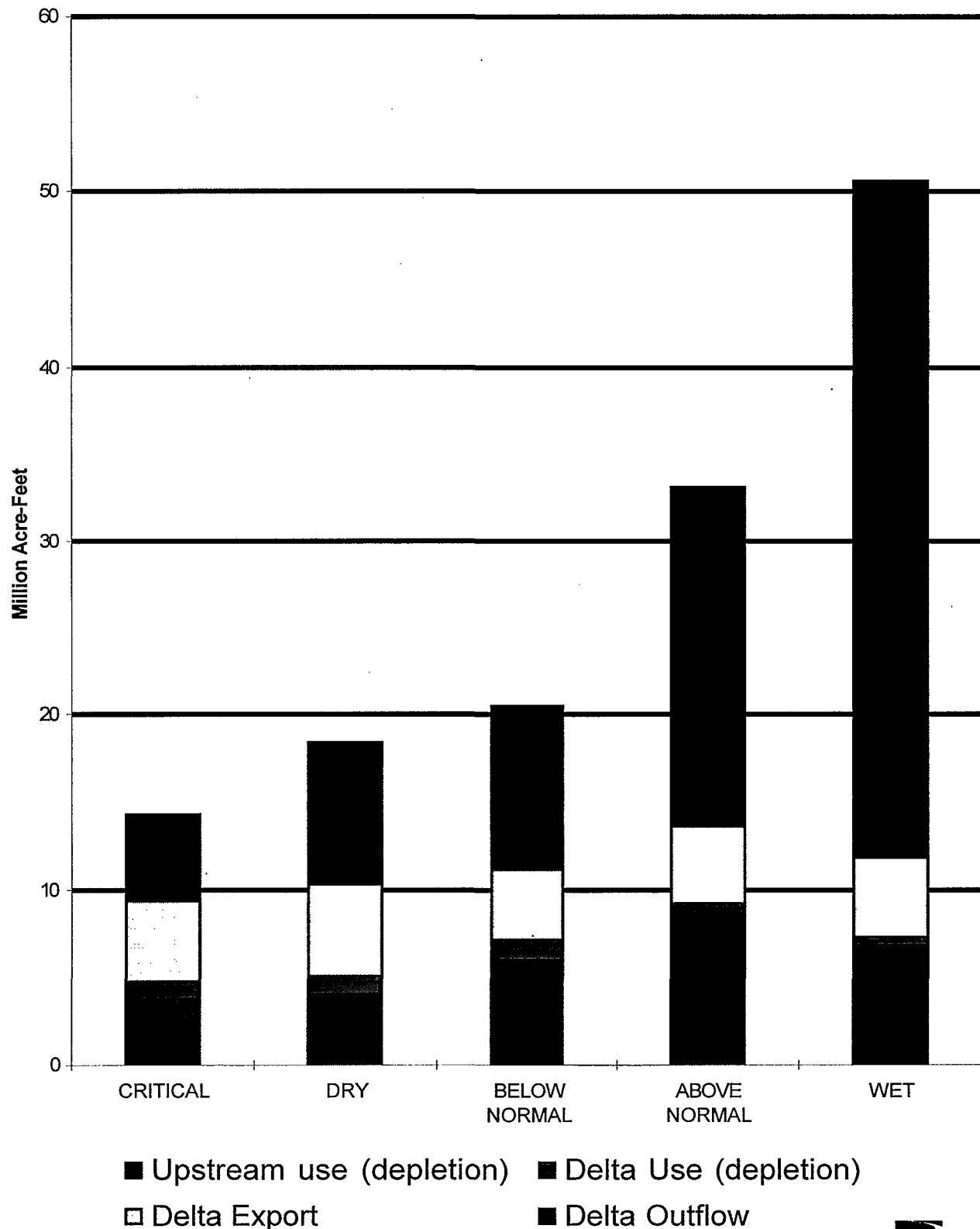
# ***Hydrological Variability***

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- Annual
- Seasonal
- Daily
- Impact/Value Variability



# Disposition of Sacramento and San Joaquin River Flows

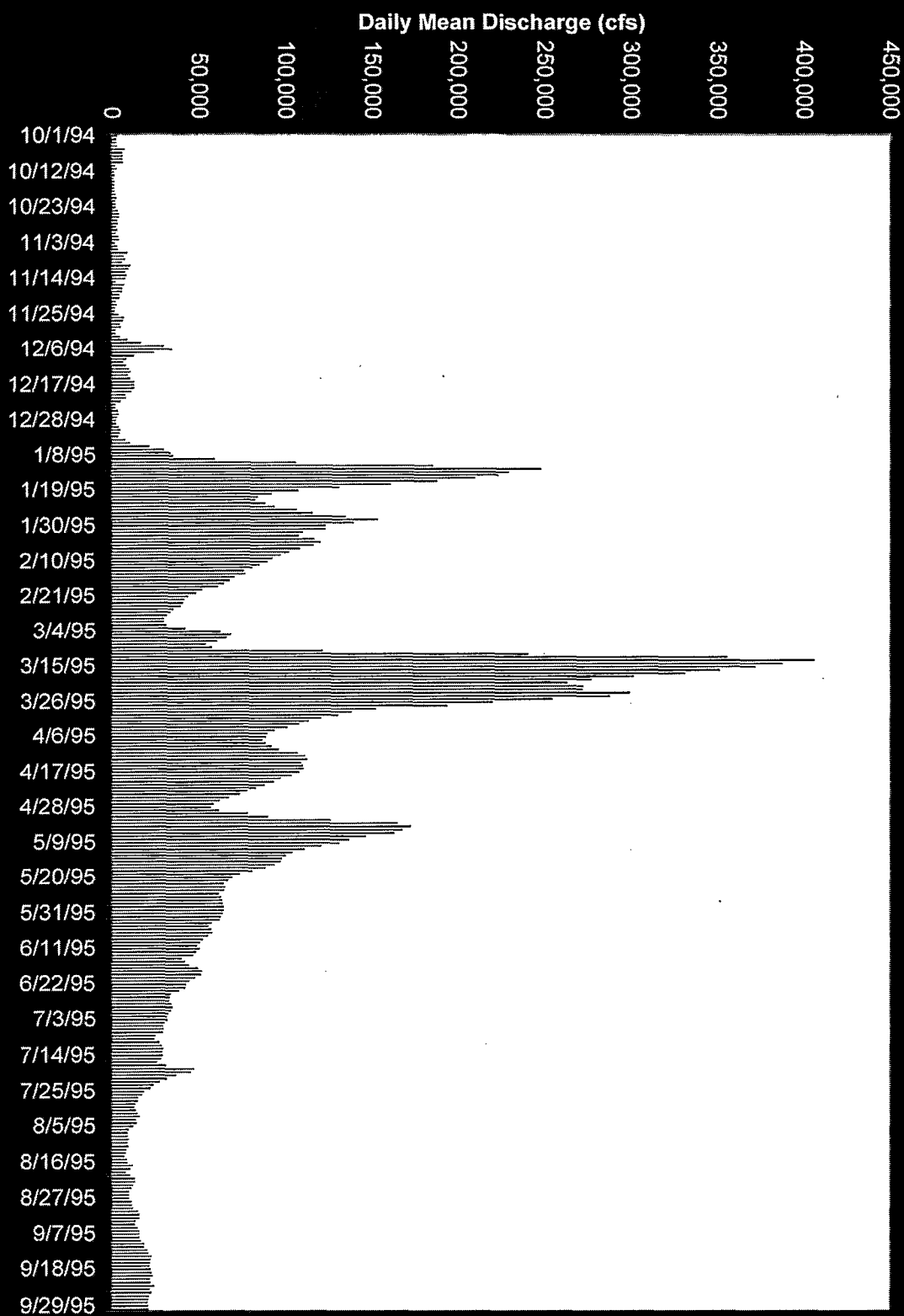


# ***% Depletion by Year Type***

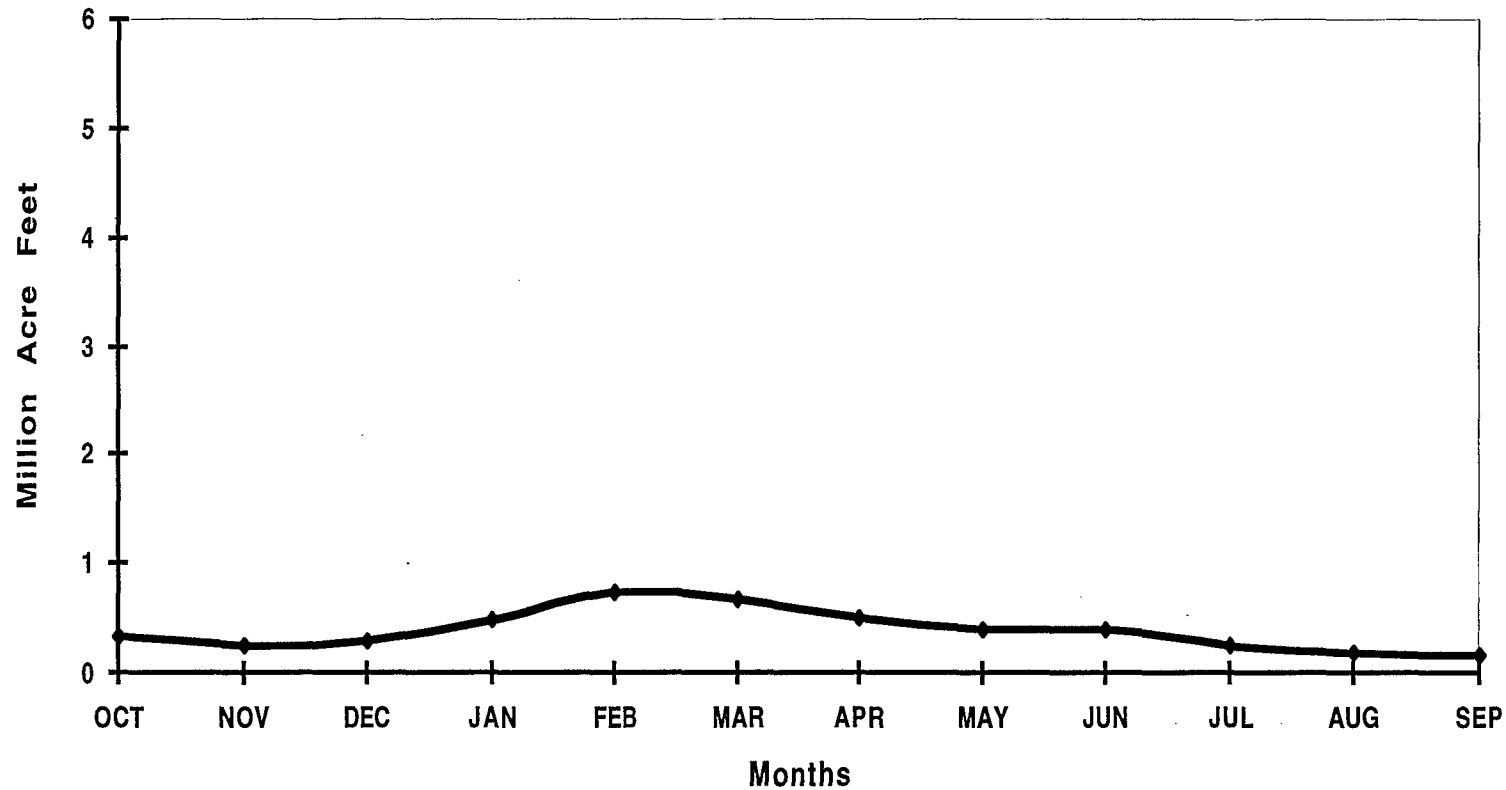
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- Wet 24%
- Above Normal 41%
- Below Normal 55%
- Dry 56%
- Critical 65%

# Historic 1995 Delta Outflow

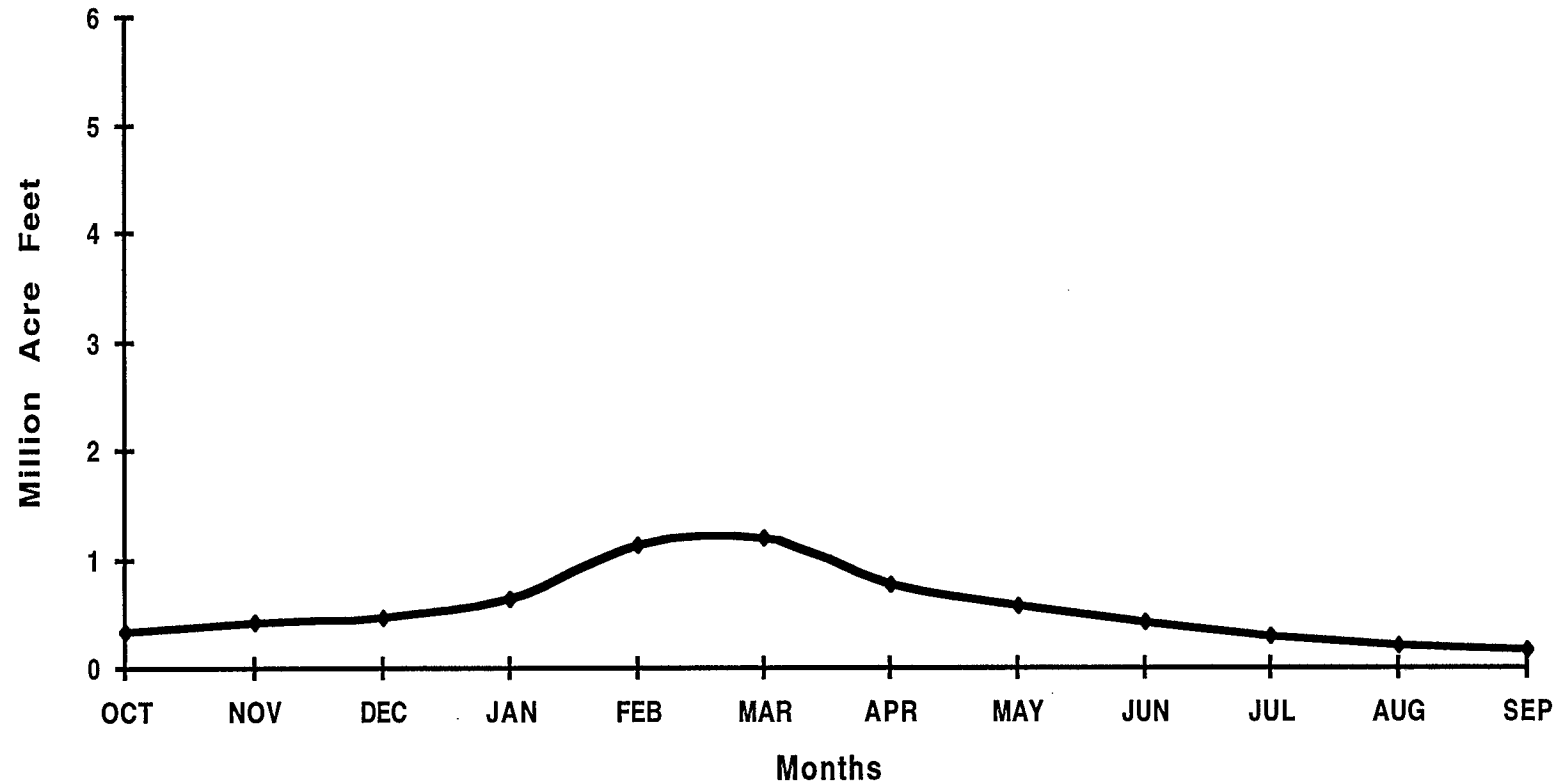


# ***Critical Years Average Monthly Delta Outflow***

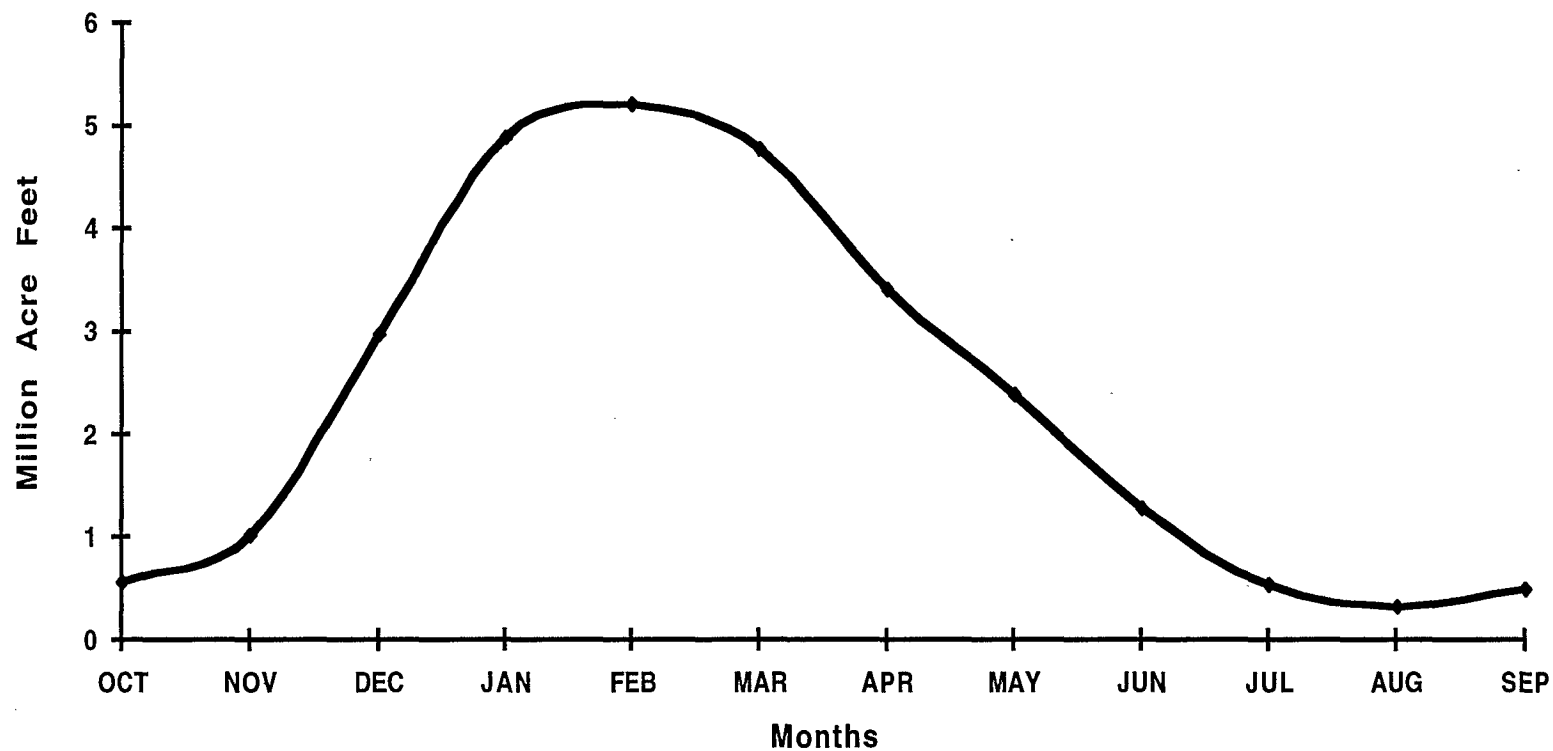


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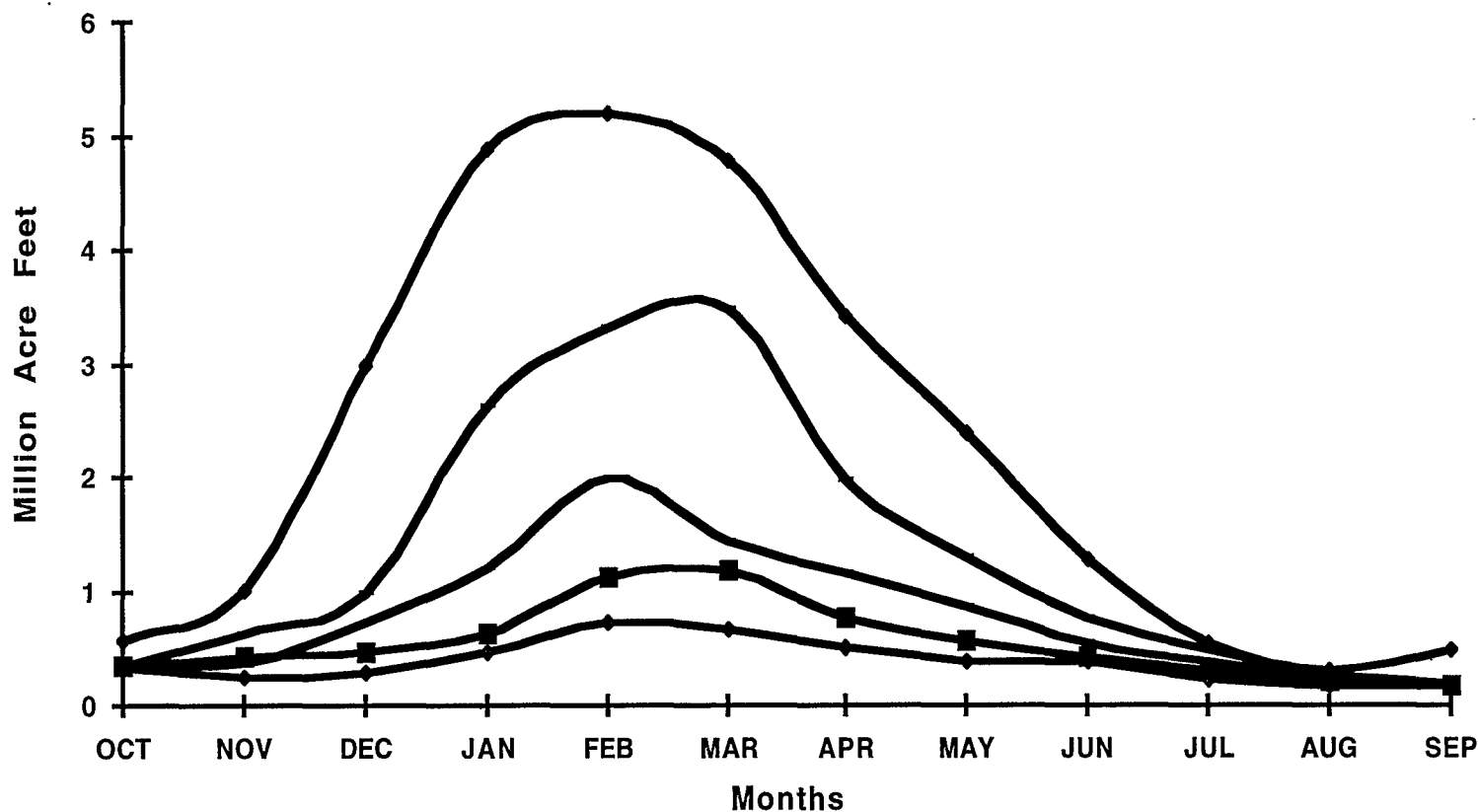
# ***Dry Years Average Monthly Delta Outflow***



# ***Wet Years Average Monthly Delta Outflow***



# ***Average Monthly 73 Year Delta Outflow***



# ***Resource Management Concept***

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- Resource Conflicts
- Increase Resistance to Impacts
- Seek Multi-Objective Strategies



# ***Water Management Concept***

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- Reduce Conflict
- Increase High Value Benefits
- Shifting Diversion Patterns

# ***Water Management Tools***

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- ERPP
- Storage
- Conveyance
- Levee Stability
- Water Quality
- Water Transfers
- Water Use Efficiency
- Watershed Management



# ***Water Use Efficiency***

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- Provide Water to Meet Currently Unmet or Future Needs
- Net Improvements for Water Supply Reliability
- Can Improve Water Quality and Reduce Ecosystem Impacts

# ***Water Transfers***

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- Effective Means of Moving Water Between Users on a Voluntary and Compensated Basis
- Water for Environmental Purposes
- Net Improvements for Water Supply Reliability

# ***Storage***

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- Low Value Water into High Value Water
- Attenuate Flood Flows
- Shift Diversions to Reduce Entrainment
- Low Impact Diversions for Increased Supplies or Greater Environmental Flows
- Improve Water Quality

# ***Conveyance***

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- Increase Operational Flexibility
- Reduce Diversion Impacts
- Improve Water Quality in Export Regions

# ***Ecosystem Restoration Program Plan***

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- Rehabilitate the Ecosystem
- Reduce Conflicts with Water Diversions
- Reduce Conflicts with Land Use

# ***Levee Stability***

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- Improve Water Supply Reliability
- Improve Land Use and Associated Economic Activities
- Improved Water Quality Reliability
- Improved Ecosystem Health



# ***Watershed Management***

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- Improved Water Quality
- Increased Water Supply

# ***The Basic Concept of Time Value is Valid***

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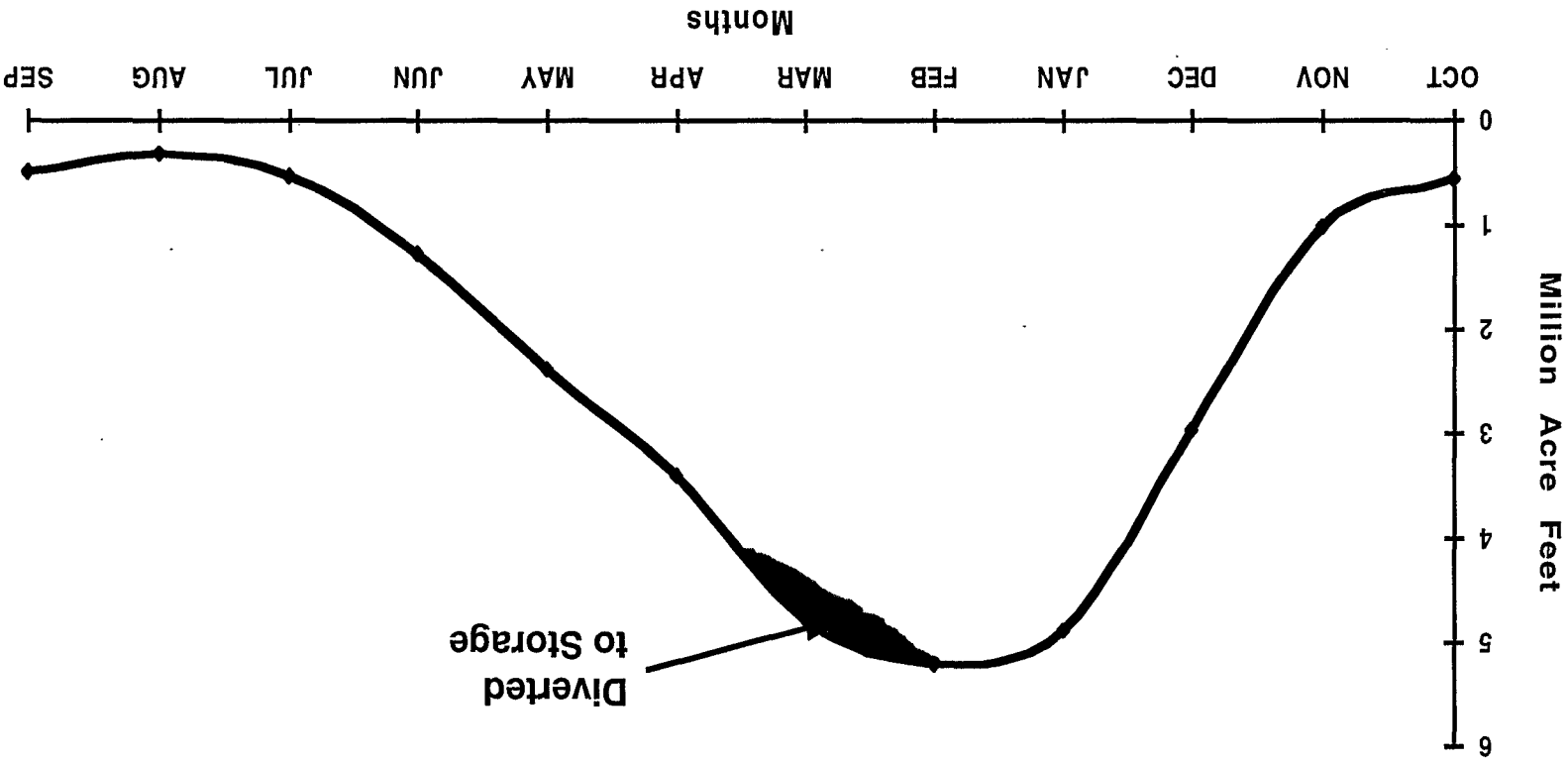
- Increase Supply
- Existing Supply
- Reduced Supply

# ***Example Illustrating Storage***

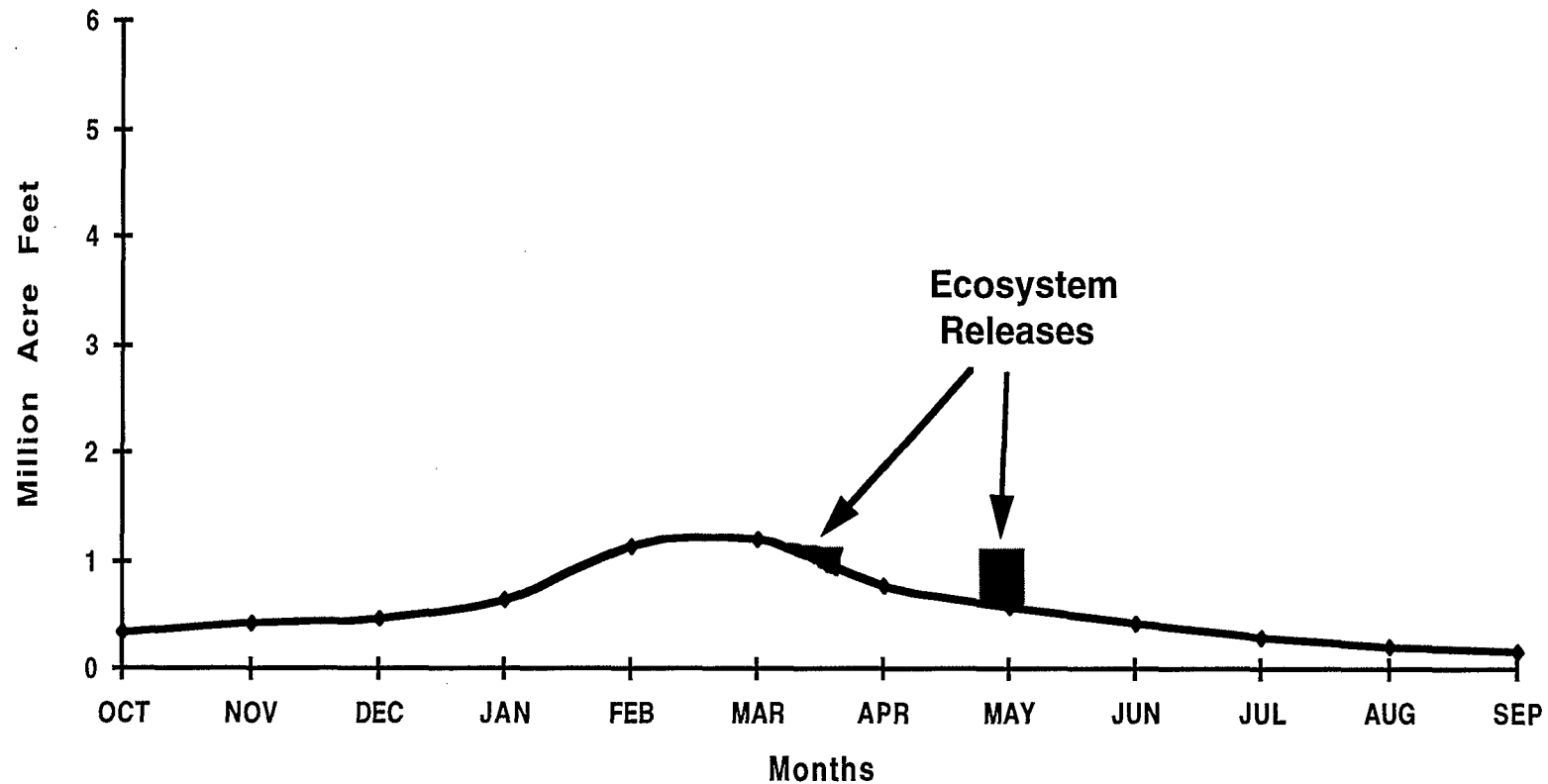
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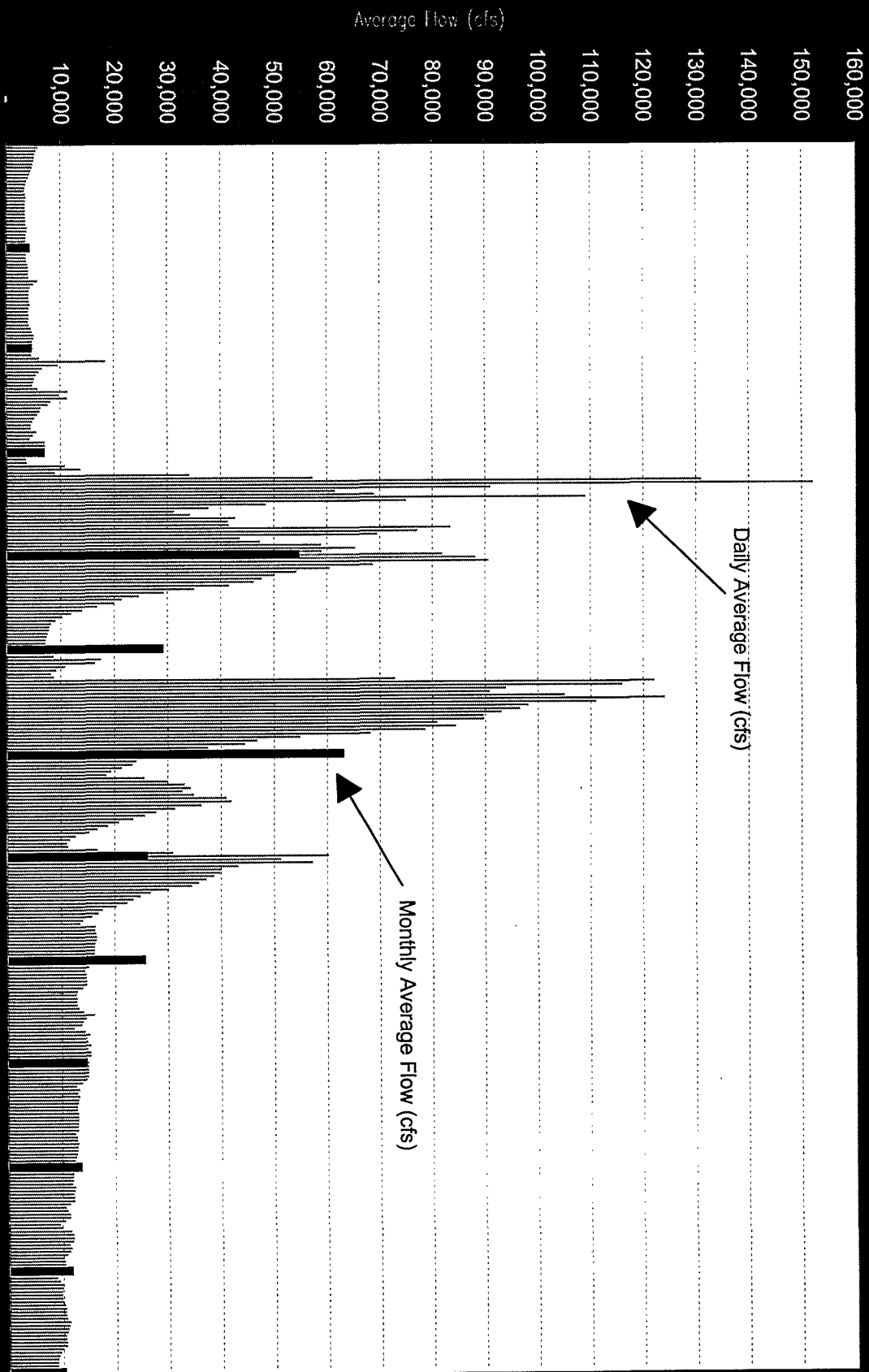
- Offstream
- Conjunctive Management

# Wet Years Average Monthly Delta Outflow



# *Dry Years Average Monthly Delta Outflow*





# ***Assumptions for this Example***

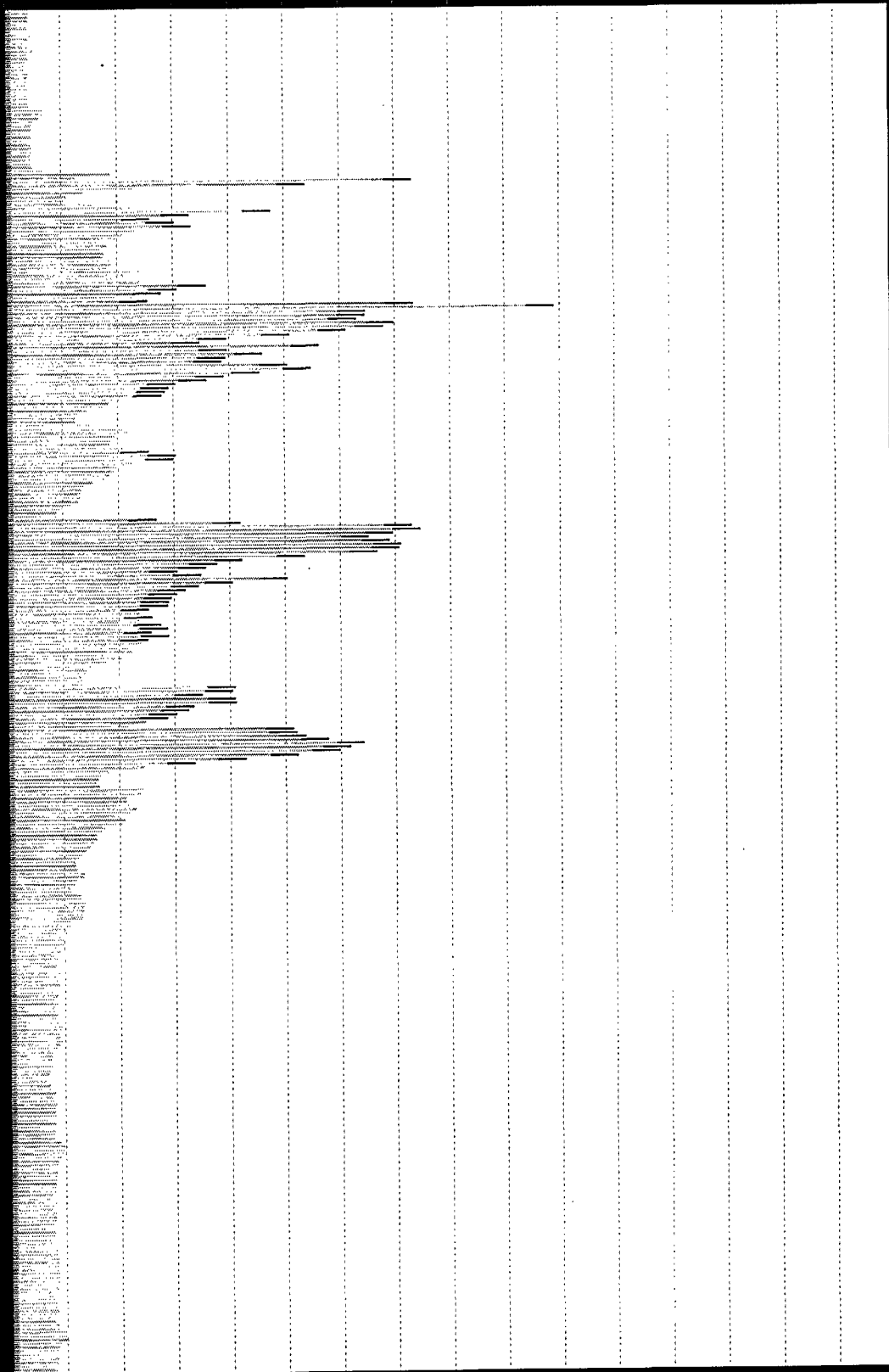
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- The Diversion Rate to Offstream Storage does not exceed 5,000 CFS.
- Flows below 25,000 CFS are not diverted to insure ability to meet downstream plan and diversion requirements.



Daily Mean Discharge (cfs)

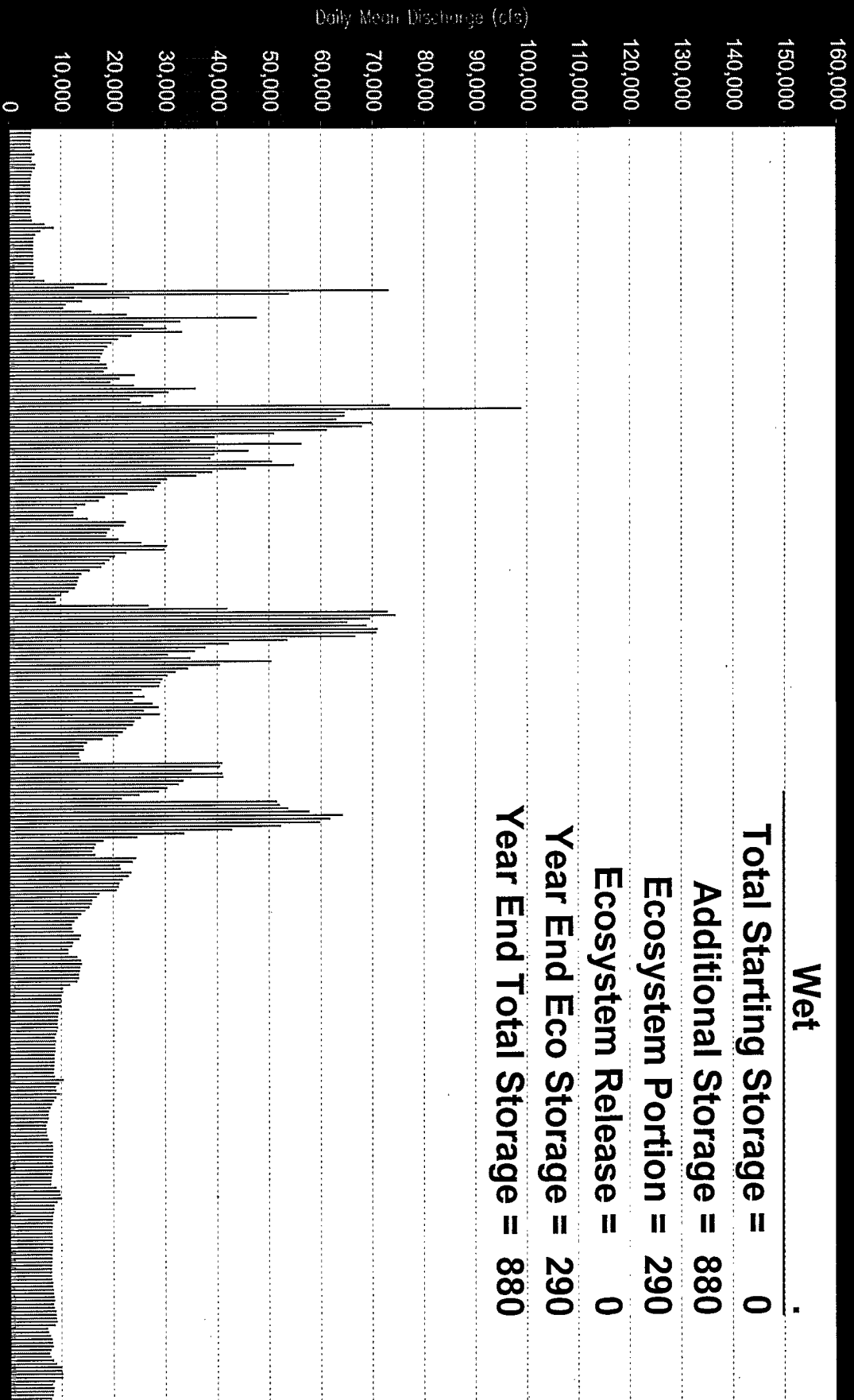
160,000  
150,000  
140,000  
130,000  
120,000  
110,000  
100,000  
90,000  
80,000  
70,000  
60,000  
50,000  
40,000  
30,000  
20,000  
10,000  
0

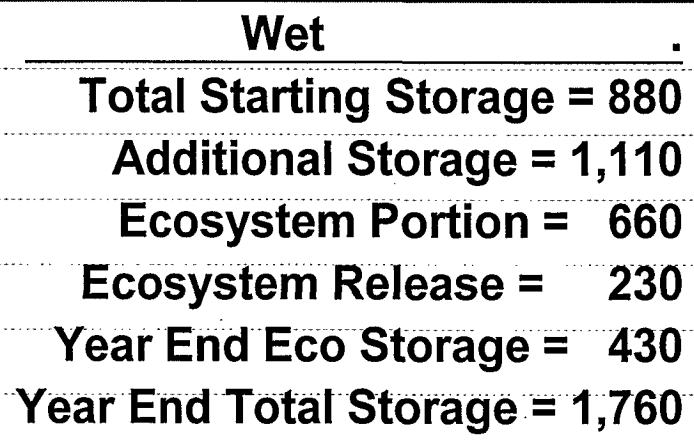


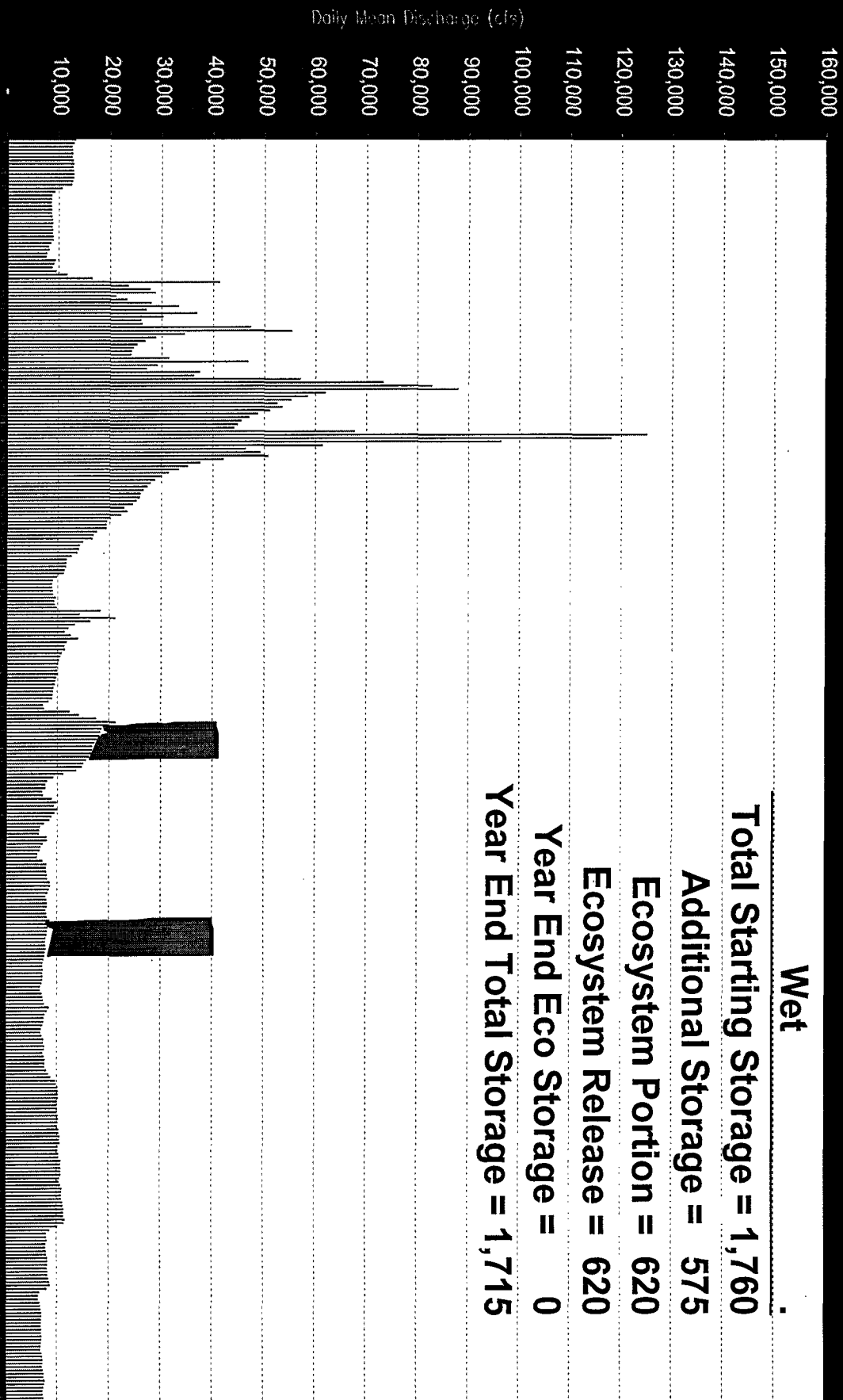
E - 0 1 6 3 6 0

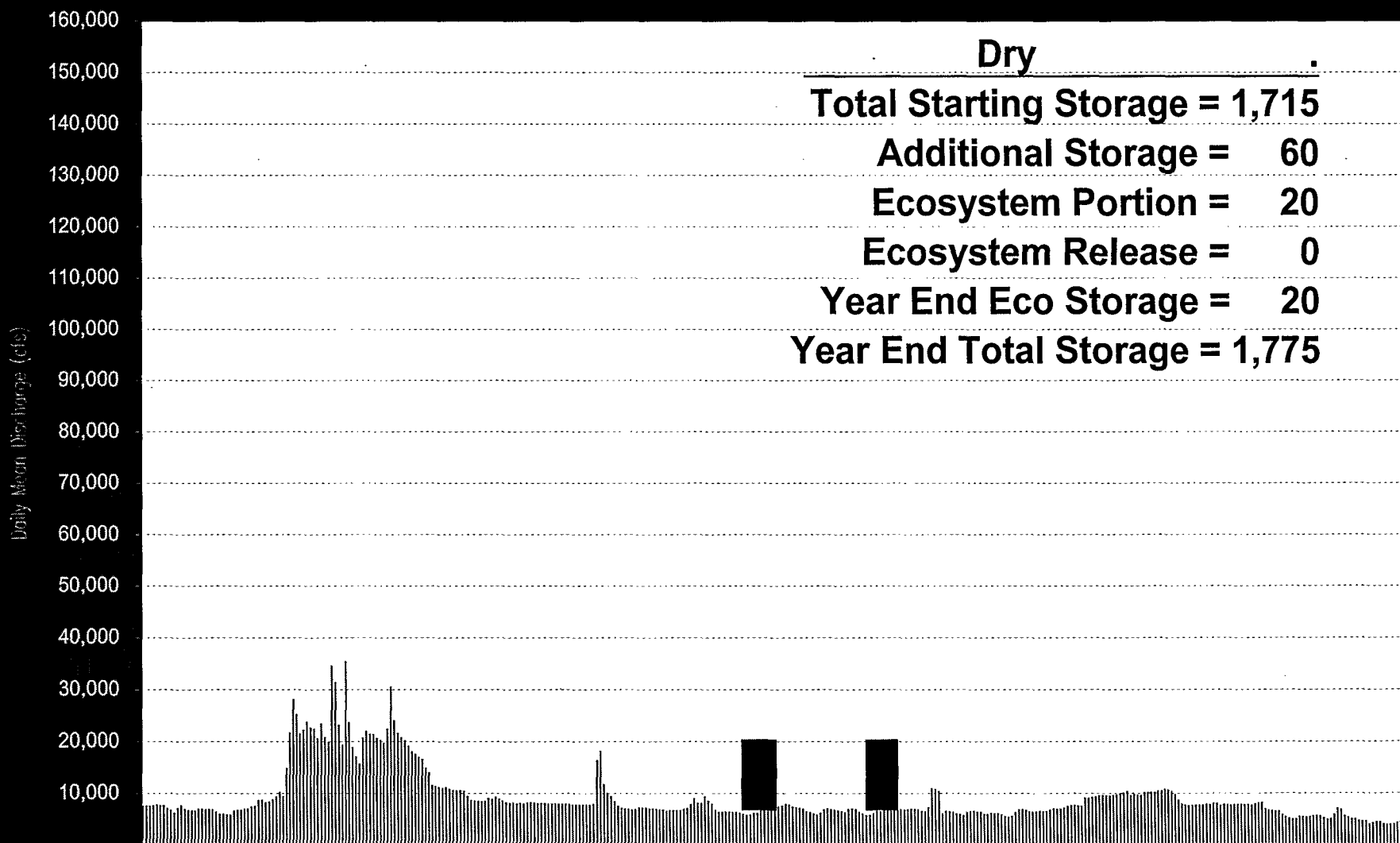
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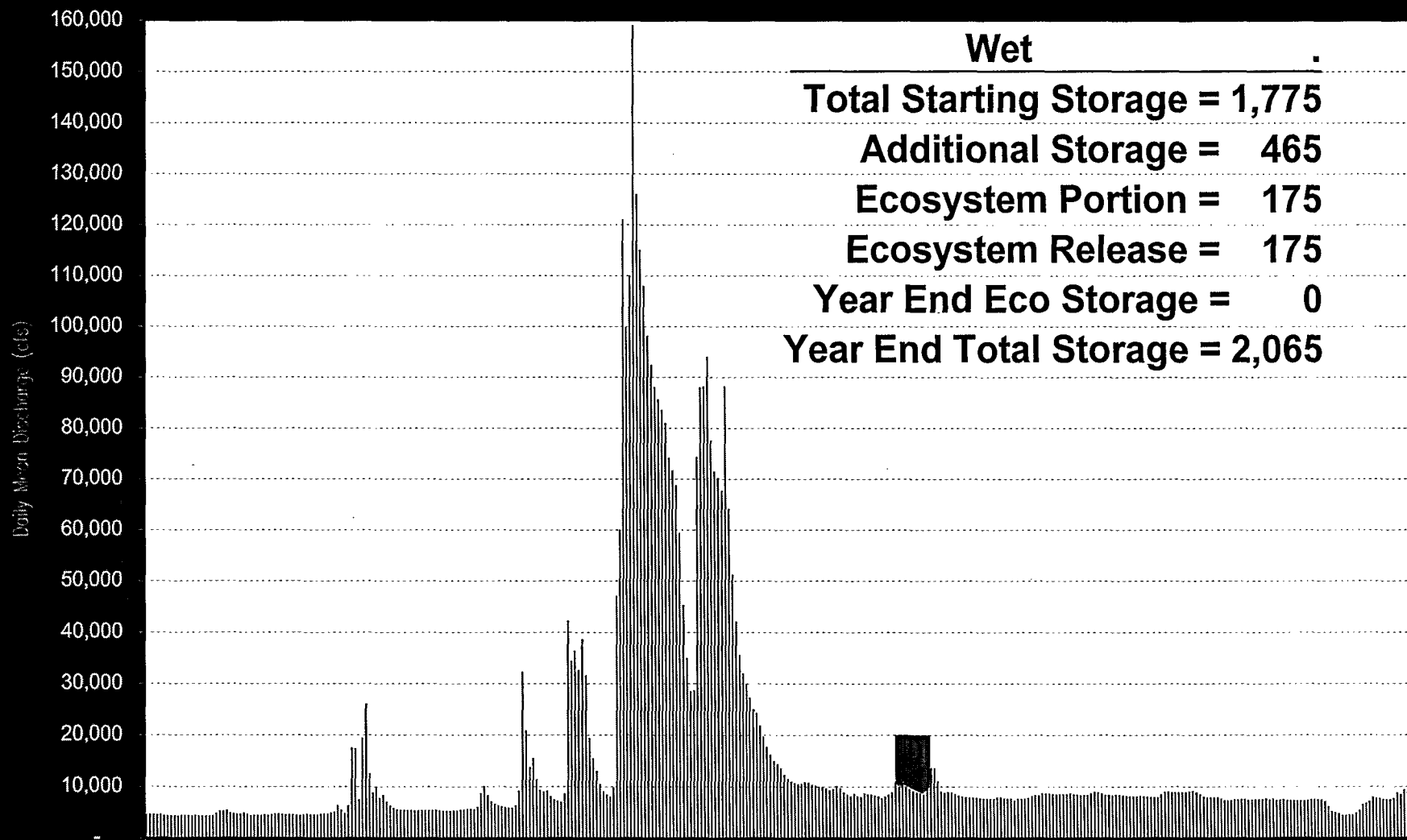


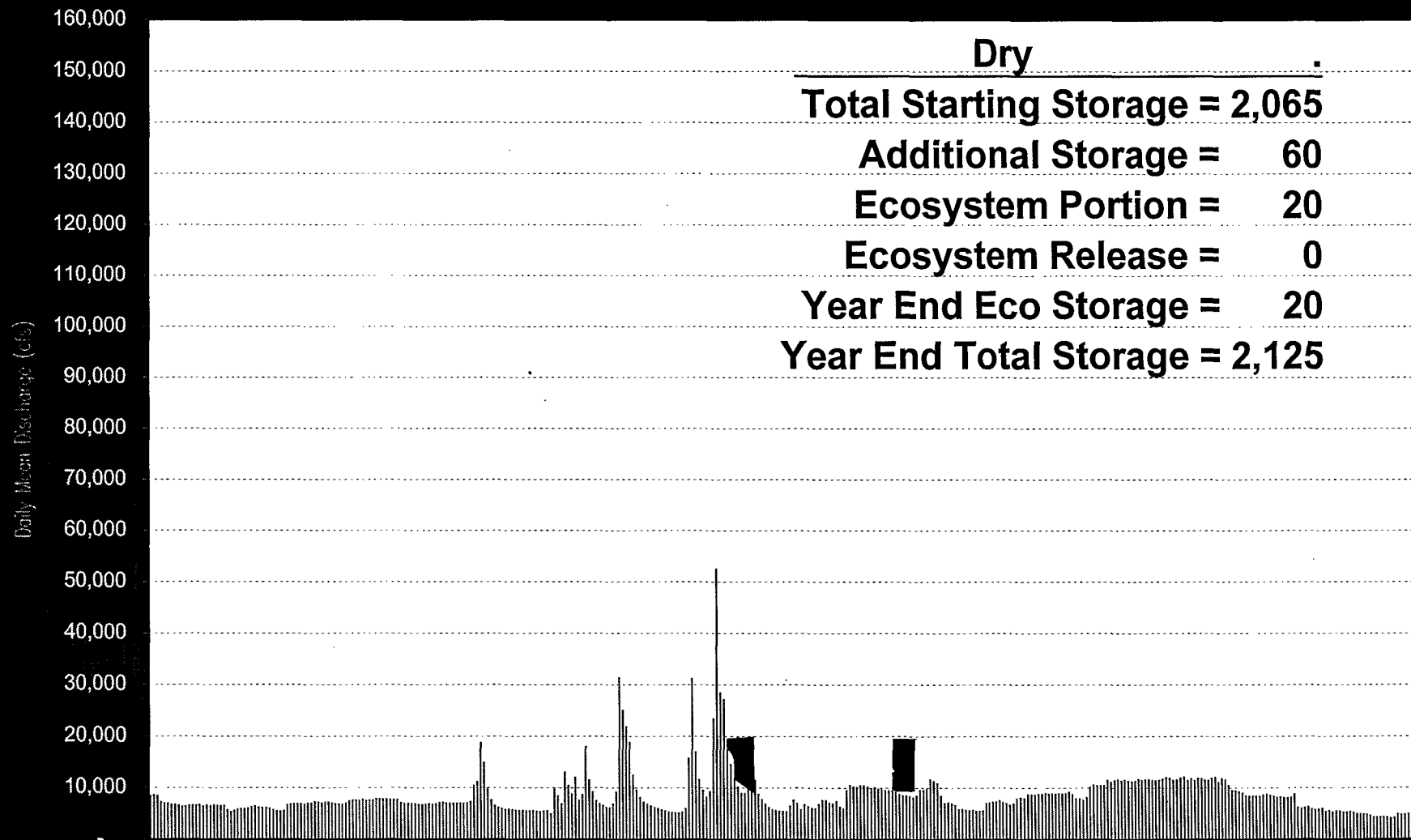












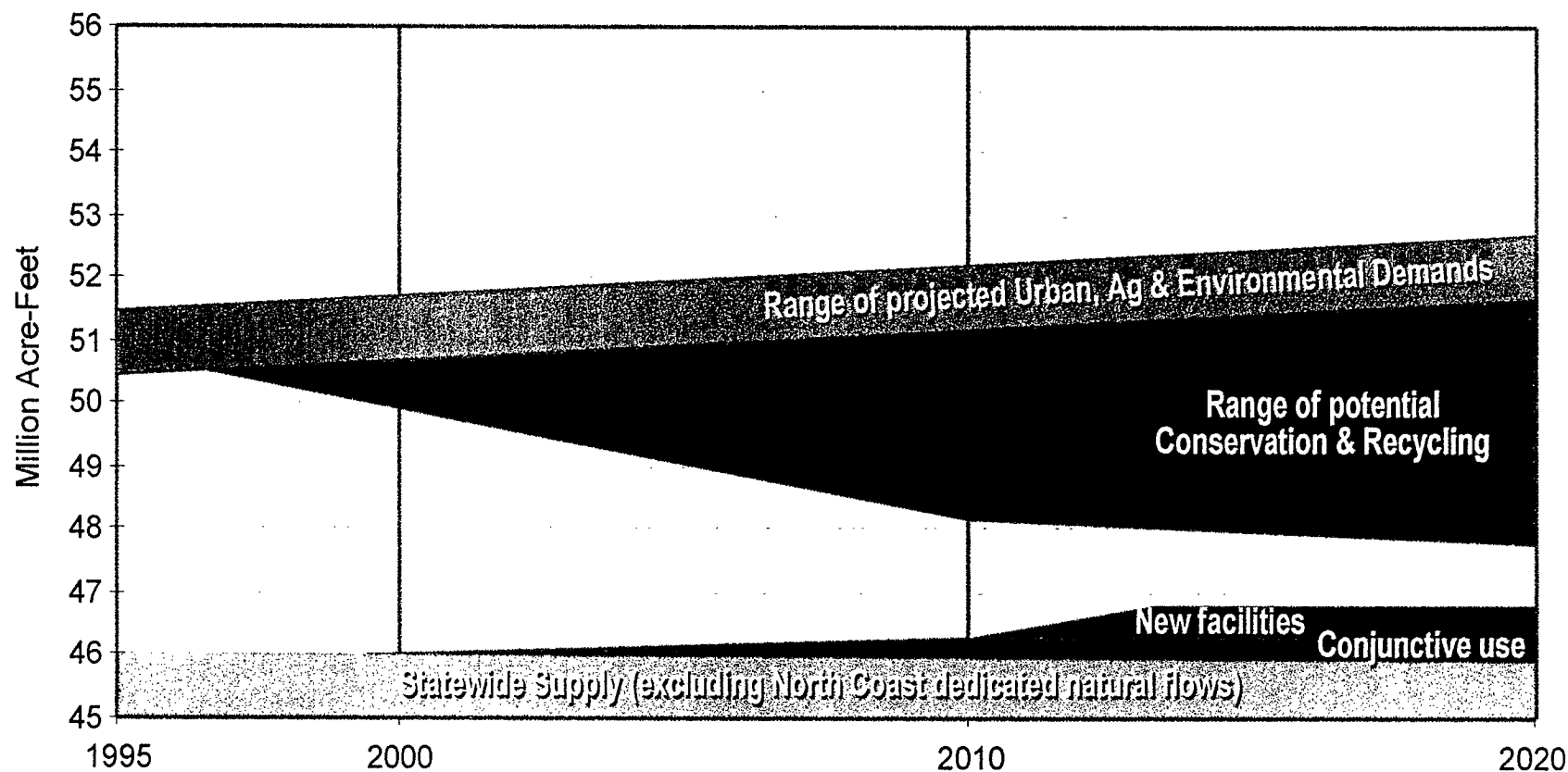
# ***CALFED Alternatives***

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- Each Integrates All Tools

**CALFED Bay-Delta Program Service Area**  
**Drought Year**  
**Demand Management Projections - Water Use Efficiency Potential**

Figure 6



1. Supply and demand values are from draft Bulletin 160-98 and have been adjusted to reflect the Central Valley Watershed (North Coast Rivers are excluded).
2. Demand range includes adjustments from baseline for existing water conservation measures and reduced agricultural acreage plus potential AFRP and ERPP needs.



# ***-Proper Balance- What is the Appropriate Role:***

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- of Storage?
- of Demand Management?

# ***Why Develop Storage?***

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Storage turns low value water into high value water.

- Attenuate flood flows.
- Shift diversions to reduce entrainment.
- Low impact diversions for increased supplies or greater environmental flows.
- Improve water quality.



# ***Why is Storage in every CALFED Alternative?***

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- Sometimes there is no acceptable substitute.
  - Major changes in diversion patterns to reduce entrainment are very difficult to achieve without increased local storage.
  - Storage allows for easier real-time environmental operations.
- Alternatives exist to storage in some cases, but can they carry full load?
  - Water transfers and water efficiency measures should be part of solution.
  - However, potential for these measures unclear.
  - Local impact unclear. Large-scale land retirement not an acceptable option.
- Storage provides assurances. More flexibility means less conflict
- Recommendation for including storage represents a planning umbrella, not a storage target.



# ***Upstream Storage***

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## Onstream storage

- Easy to fill and empty.
- Increase instream flows, dry year supplies, flood control, temperature control and hydropower.

## Offstream surface storage

- More limited input/output capacity.
- Increase instream flows, dry year supplies, flood control, temperature control.
- Modify local diversion patterns to reduce entrainment.

## Groundwater storage

- Similar to offstream surface storage, but....
- Lower input/output rates.
- Groundwater-surface water interactions can impact local users and reduce benefits in areas with high water tables.



# ***Storage in Export Areas***

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## Off-Aqueduct Surface Storage

Fill during low impact periods. Use for:

- Increased exports
  - Reduced entrainment
  - San Joaquin Valley wetlands
  - Increased San Joaquin River flows
  - Improved water quality in the export areas
  - Increased security against major outages in the Delta
- 
- Export constraints limit ability to fill.
  - Near-Delta storage less constrained if they have their Delta intakes.



# ***Storage in Export Areas - cont***

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Groundwater storage

Like off-aqueduct surface storage, but...

- limited canal capacity.
- limited local distribution capacity.
- low rates of input and output of water.



# ***Phasing/Sequencing Alternatives***

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It may be possible to sequence the development of storage to assure an appropriate amount.

For example:

- Acquire easements.
- Develop storage to meet needs that cannot reasonably be met without storage.
- Set reasonable limits on the transferability of water.
- If additional water needs remain, pursue acquisition of additional storage.



# ***Land Retirement Analysis***

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- Land Retirement to Reduce Water Demand Not Included in Phase II Draft Alternatives
- Additional Analysis Needed to Move Forward
  - Some Stakeholders Advocate Inclusion
  - Clean Water Act 404 (b) (1) Analysis
- Significant Public Policy Issues Not Conveyed in this Technical Analysis





# ***Land Retirement Analysis***

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- Request Comments from Stakeholders ASAP
  - Technical: Are Our Numbers Right?
  - Policy: Significance of Impacts, Failure to to meet Solution Principles
- We will Continue to Refine Analysis



# ***Land Retirement Analysis***

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## Analysis Results:

- Retire 500,000 Acres in San Joaquin Valley
- Net Water Savings About 1.4 MAF/Yr.
- Cost About \$2.25 Billion Plus O&M
- Water Cost Range \$60 to \$300 Per Acre-foot  
Average \$150/af



# ***Land Retirement Analysis***

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- Regional Distribution of Retired Land

Delta Mendota Service Area	170,000 acres
Westlands Area	120,000 acres
Tulare Lake Bed	140,000 acres
Kern County	70,000 acres

(Acreage allocation based on drainage-impacted lands identified in "Rainbow Report")

- Analysis of Impacts Used CVPM, IMPLAN Models



# ***Land Retirement Analysis***

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- Cropping Reductions:

Cotton	230,000 acres
Field Crops	150,000 acres
Alfalfa Hay	100,000 acres
Vegetables	15,000 acres
Rice, Trees, Vines	5,000 acres

- Annual Loss in Personal Farm Income: \$160 million
- Annual Loss in State and Local Taxes: \$16 million
- Job Loss: 6400 (Nearly 22,000 Lost, Over 15,000 Gained)

